UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/998,284	11/30/2001	Charlotte Horsmans Poulsen	674523-2012	5487

27890 7590 05/25/2007

STEPTOE & JOHNSON LLP
1330 CONNECTICUT AVENUE, N.W.
WASHINGTON, DC 20036

EXAMINER	
NASHED, NASHAAT T	
ART UNIT	**PAPER NUMBER**
1656	

MAIL DATE	DELIVERY MODE
05/25/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	09/998,284	POULSEN ET AL.	
	Examiner	Art Unit	
	Nashaat T. Nashed, Ph. D.	1656	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 April 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3,9-15,34,35 and 40-50* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3,9-15,34,35 and 40-50* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

The Pre-Appeal Brief filed April 5, 2007 has been fully considered. It has been decided to withdraw the finality of the previous Office action mailed December 13, 2006, in order to modify the rejections of record as shown bellow.

Claims 1-3, 9-15, 34, 35, and 40-50 are under consideration.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-3, 9-15, 34, 35, and 40-50 are rejected under 35 U.S.C. 103 as being unpatentable over Hamade *et al.* (IDS: reference AF, EP-0866103 A1) in view of US patent 5,770,188 ('188, Hamade *et al.*), Hansen *et al.* [J. Biol. Chem. 272 (17), April 25, 1997, pages 11581-11587] and James *et al.* [J. Food Biochem. 1997, 21, 1-52].

Hamade *et al.* teach a method preventing fouling surfaces submerged in water by in which an anti-fouling agent is produced by an enzyme action on its substrate, and anti-fouling composition comprising an enzyme and its substrate, see abstract. They specifically teach several combinations of enzymes and substrates capable of producing hydrogen peroxide including the reactions catalyzed by glucose and hexose oxidase. See pages 5, lines 14-22. Also, they teach that the substrate of the enzyme that produces the antifouling agent can be generated by the action of another enzyme or enzymes, see page 3, lines 38-46, as well as the control release of the antifouling agent produced by the action of the enzyme in a paint composition. In addition, Hamade et al. teach a coating composition containing the various many of the component listed in instant application claim 42 including binder, as well as coating various surfaces partially or totally covered with water. See page 6, lines 28-39 and page 7, lines 14-17.

The '188 patent teaches modified enzymes including polysaccharide decomposing enzymes such as glucoamylase and amylogucosidase, and oxidoreductases such as glucose oxidase with lipophilic compound to be used in pant composition having antifouling activity. The modified enzymes are active in the paint composition and stable, and capable of forming paint films having antifouling activity. See abstract, column 3, last paragraph, column 4, first paragraph and lines 30-35, column 7, lines 4-16, and claim 4. Also, the patent teaches the use of the modified enzyme with natural and synthetic resin that can

be degraded by the modified enzyme. Said resin includes starch. See column 6, line 18 through column 7, line 15.

James *et al.* is a review article on glucoamylases, microbial source and industrial applications. It teach that glucoamylase catalyzes the hydrolysis from the non-reducing chain ends by cleaving α-1,4 and α-1,6 glycosidic bonds consecutively and its use for the hydrolysis of starch for various purposes, see the abstract, and that gluciamylase has been loosely called amyloglucosidase, see the introduction at page 2, line 2. They teach that starch consists of two branched polysaccharides named amylose and amylopectin both of which are made of glucose, see starch structure starting at page 2. The various starch hydrolases action on starch and the product of hydrolyses of α-amylase, β-amylase and glucoamylases. Only, glucoamylase produces glucose whereas the others produce oligosaccharides and disaccharides, see page 4. Glucoamylase convert starch completely to glucose, see page 5, second paragraph. There are several known glucoamylases from various biological sources having suitable properties for industrial application, see page 9-16. James *et al.* teach that Glucoamylase is cheep and commercially available as a free enzyme or immobilized enzyme from several source, see page 22-25 and Table 2 in particular at page 23.

Hansen et al. teach the hexose oxidase from *Chondrus cripus* which catalyzes the oxidation of a variety of mono- and disaccharides including glucose, galactose, maltose, cellobiose and lactose to produce the corresponding lactones and hydrogen peroxide, see abstract, the first paragraph following the abstract, and Table III, on page 11586. Also, they teach that the use of functionally related enzyme glucose oxidase in the production of hydrogen peroxide among other uses, and suggested that the hexose oxidase from *C. cripus* would be a superior substitute for glucose oxidase because of its broader substrate specificity. In addition, they teach the cloning and expression of said hexose oxidase, and report the amino acid sequence and nucleic acid encoding said amino acid sequence, see Figure 3 on page 11585. The amino acid sequence reported in Figure 3 is identical to that of SEQ ID NO: 2 of the instant application.

Hamade *el al.* teach an anti-fouling composition comprising hexose oxidase, when acts on its substrate produces the antifouling compound hydrogen peroxide. Also, they suggested the use of another enzymes to produce the substrate for said oxidase. The '188 patent provides one of ordinary skill in the art with motivation to use glucoamylase and starch as they taught stable and durable antifouling composition comprising starch and glucoamylase. Thus, it would have been obvious at the time of invention for one of ordinary skill in the art to formulate an antifouling composition such as that taught in the '188 patent that includes the two enzyme in which a first enzyme glucoamylase act on its substrate, i.e., starch to produce the glucose substrate for the second enzyme.

In tern, the hexose oxidase act on glucose to produce the antifouling agent hydrogen peroxide (Claims 1, 11-15, 34, 35, 40, 42, 45, 49, and 50). Hansen et al. provide one of ordinary skill in the art at the time of invention with motivation to use the hexose oxidase from *C* as they teach that hexose oxidase is a superior substitute to glucose oxidase for all of its uses because of its broader substrate specificity. Thus, it would have been obvious at the time of invention to one of ordinary skill in the art to formulate the anti-fouling composition as taught by the combined teaching of Hamade *et al.* and the '188 patent comprising a precursor substrate such as starch, a first enzyme amyloglucosidase, and the second enzyme hexose oxidase, taught by Hamade *et al.*, in particular, that from *C. crispus*, a marine organism, taught by Hansen *el al.*, and use said composition to treat surfaces such as outdoor wood work and the hull of marine vessels (claim 1-3, 9-15, 34, 35, 40, 43, 44, and 46-50). Also, Hamade *et al.* teach the use of surface coating material in the antifouling composition that include acrylic resin among others (claim 42). It should be noted that, although Hamade *el al.* do not teach specifically the use of amyloglucosidase to act on the precursor substrate to produce the substrate for the hexose oxidase, they teach any enzyme/substrate combinations that lead to the formation of any substrate for the hexose oxidase would be a good combination, see page 3, lines 38-46, and the '188 patent have taught the combination of amylogucosidase and starch in antifouling composition. Another motivation one of ordinary skill in the art to use amyloglucosidase with starch comes from the teaching of James *et al.* which teach the commercial availability of the enzyme from various sources having different properties and stability, the complete hydrolysis of starch to glucose, and the fact that the only product of the action amylocosidase is glucose, which is the desired substrate for hexose oxidase (claim 9, 10, 34, and 35). Another useful property of amyloglucosidase taught by James would have further motivated the ordinary skill in the art, is its ability to act on purified and raw starch, see Table 1 at page 10. Thus, the claimed invention was within the ordinary skill in the art to make and use at the time was made and was as a whole, clearly *prima facie* obvious.

Claims 1-3, 9-15, 34, 35, and 40-50 are rejected under 35 U.S.C. 103 as being unpatentable over Hamade *et al.* (IDS: reference AF, EP-0866103 A1) in view of US patent 5,770,188 ('188, Hamade *et al.*), U. S. Patent 6,251,626 B1 [626 patent, Stougaard *et al.*] and James *et al.* [J. Food Biochem. 1997, 21, 1-52].

The teaching of Hamade *et al.*, '188 patent, and James *et al.* are summarized above.

The '626 patent teaches the purification and cloning of hexose oxidase from *Chondrus crispus* which catalyzes the oxidation of a variety of mono- and disaccharides including glucose, galactose, maltose, cellobiose and lactose to produce the corresponding lactone and hydrogen peroxide, see abstract, the first

paragraph following the abstract, and Technical Background, column 1 and 2. Also, they teach that the use of functionally related enzyme glucose oxidase in the production of hydrogen peroxide among other uses, and suggested that the hexose oxidase from *C. crispus* would be a superior substitute for glucose oxidase because of its broader substrate specificity, see column 1. In addition, they teach the expression of said hexose oxidase, and report the amino acid sequence and nucleic acid encoding said amino acid sequence, SEQ ID NO's: 31 and 30, respectively. The amino acid sequence of SEQ ID NO: 31 of the 626 patent differs only in one amino acid residue from that of SEQ ID NO: 2 of the instant application.

Hamade *el al.* teach an anti-fouling composition comprising hexose oxidase, when acts on its substrate produces the antifouling compound hydrogen peroxide. Also, they suggested the use of another enzymes to produce the substrate for said oxidase. The '188 patent provides one of ordinary skill in the art with motivation to use glucoamylase and starch as they taught stable and durable antifouling composition comprising starch and glucoamylase. Thus, it would have been obvious at the time of invention for one of ordinary skill in the art to formulate an antifouling composition such as that taught in the '188 patent that includes the two enzyme in which a first enzyme glucoamylase act on its substrate, i.e., starch to produce the glucose substrate for the second enzyme. In tern, the hexose oxidase act on glucose to produce the antifouling agent hydrogen peroxide (Claims 1, 11-15, 34, 35, 40, 42, 45, 49, and 50). Hansen et al. provide one of ordinary skill in the art at the time of invention with motivation to use the hexose oxidase from *C* as they teach that hexose oxidase is a superior substitute to glucose oxidase for all of its uses because of its broader substrate specificity. Thus, it would have been obvious at the time of invention to one of ordinary skill in the art to formulate the anti-fouling composition as taught by the combined teaching of Hamade *et al.* and the '188 patent comprising a precursor substrate such as starch, a first enzyme amyloglucosidase, and the second enzyme hexose oxidase, taught by Hamade *et al.*, in particular, that from *C. crispus*, a marine organism, taught by Hansen *el al.*, and use said composition to treat surfaces such as outdoor wood work and the hull of marine vessels (claim 1-3, 9-15, 34, 35, 40, 43, 44, and 46-50). Also, Hamade *et al.* teach the use of surface coating material in the antifouling composition that include acrylic resin among others (claim 42). It should be noted that, although Hamade *el al.* do not teach specifically the use of amyloglucosidase to act on the precursor substrate to produce the substrate for the hexose oxidase, they teach any enzyme/substrate combinations that lead to the formation of any substrate for the hexose oxidase would be a good combination, see page 3, lines 38-46, and the '188 patent have taught the combination of amylogucosidase and starch in antifouling composition. Another motivation one of ordinary skill in the art to use amyloglucosidase with starch comes from the teaching of James *et al.* which teach the commercial availability of the enzyme from various sources having different properties and stability, the complete hydrolysis of starch to glucose,

and the fact that the only product of the action amylocosidase is glucose, which is the desired substrate for hexose oxidase (claim 9, 10, 34, and 35). Another useful property of amyloglucosidase taught by James would have further motivated the ordinary skill in the art, is its ability to act on purified and raw starch, see Table 1 at page 10. Thus, the claimed invention was within the ordinary skill in the art to make and use at the time was made and was as a whole, clearly *prima facie* obvious.

In response to similar rejection in the previous Office action, Applicants reiterated their previous arguments and assert that Hamade *et al.* do not teach the claimed composition because Hamade *et al.* do not teach or suggest the two-enzyme composition.

Applicants arguments filed 4/5/07 have been fully considered, but they are found unpersuasive. As indicated in the previous Office actions if Hamade *et al.* do not teach explicitly the two-enzyme system claimed they have clearly suggested the system. They specifically stated:

> It should be understood that said compound having antimicrobial activity may be a compound obtained as the direct result of enzymatic reaction between the enzyme and the substrate or a compound formed from the product of such enzymatic reaction through further enzymatic or chemical reaction.

The statement as presented that the antifouling compound can be produced directly by the direct action of an enzyme on its substrate or through a compound formed through further enzymatic reaction. The statement does not qualify the number of enzymatic reactions or the source of other enzymes, and clearly indicates a multienzyme composition is within Hamade *et al.* teachings. Thus, the teaching of more than one enzyme to produce the antifouling compound is clearly suggested. The '188 patent which teach a stable and durable antifouling composition comprising amyloglucosidase and starch was added to provide a nexus between amyloglucosidase and antifouling composition and expectation of success. The teaching of the '188 patent should overcome any doubt the applicants may have about the obviousness of their invention. It is undisputed fact that an antifouling composition comprising the hexose oxidase and one of its multiple known substrate is taught by Hamade *et al.* Amyloglucosidase is a well known industrial enzymes used to convert starch to glucose, used in antifouling composition taught by the '188 patent, and commercially available in different form and properties, which would have provided motivation to the ordinary skill in the art to specifically use the combination of amyloglucosidase and starch in the composition. Thus, the claims are *prima facie* obvious over the cited prior art of record.

Applicants allege Hamade's disclosure teaches away from the present invention as it suggests that a composition comprising an enzyme, substrate, and

a film-forming resin is sufficient to overcome the problem of controlled release of the microbial agent. As indicated above and in several previous Office actions, that is possible because of the explicit suggestion if not teaching of two or more enzymes to produce the antifouling compound.

With regard to the argument that Hamade provide large list of non-limiting enzyme-substrate combinations, which generate a large number of different anti-microbial agents, the fact that Hamade *et al.* teach multiple enabled embodiment does not disqualify it as a prior art. The preferred embodiment in the instant application, which is the use of starch and amyloglucosidase to produce sugars, which in turn is oxidized with hexose oxidase meet the legal definition of obviousness based on the cited prior art of record. No matter how many time the applicant repeat that Hamade *et al.* do not teach or suggest two-enzyme system would not change the record and their state at page 3, line 38-46 and reproduced above. Contrary to applicants' allegation that Hanse *et al.* and James *et al.* do not remedy the defect of Hamade *et al.*, both reference provide motivation to one of ordinary skill in the art to use particular material used in the composition. Now the '188 patent clearly provides the teching of amylglucoamylase and starch in antifouling composition.

No claim is allowed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nashaat T. Nashed, Ph. D. whose telephone number is 571-272-0934. The examiner can normally be reached on MTWTF.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kathleen K. Bragdon can be reached on 571-272-0931. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Nashaat T. Nashed, Ph. D.
Primary Examiner
Art Unit 1656